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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/694,263

10/27/2003

Shuzo Sato

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EXAMINER

WILKINS III, HARRY D

ART UNIT

PAPER NUMBER

1742

DATE MAILED: 06/07/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

<b>Office Action Summary</b>	<b>Application No.</b> 10/694,263	<b>Applicant(s)</b> SATO ET AL.	
	<b>Examiner</b> Harry D. Wilkins, III	<b>Art Unit</b> 1742	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 24 April 2006.
- 2a) ☒ This action is **FINAL**.                      2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 6-19 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 6-19 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 27 October 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All    b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☒ Certified copies of the priority documents have been received in Application No. 10/304,174.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)  | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                                   | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____  |

## **DETAILED ACTION**

### ***Status***

1. The rejection grounds based on Uzoh et al (US 5,911,619) have been withdrawn since there is no actual alternation of the processing techniques. Uzoh et al teach a continuous supply of current such that electropolishing constantly occurs. Therefore, there is no alternation between electropolishing and chemical mechanical polishing.

### ***Claim Rejections - 35 USC § 112***

2. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

3. Claims 6-19 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

4. Each of claims 6, 12 and 16 recite in the preambles thereof "[a] polishing method for polishing a metal film formed on a wafer surface having concave and convex patterns so as to fill concave portions on said wafer surface" (emphasis added). However, the polishing method does not add material to the wafer surface. The concave portions of the wafer surface had been previously filled by another method, such as electroplating, and the polishing method is used to remove the overburden from the wafer surface caused by the electroplating. Thus, the polishing method does not fill the concave portions. A more accurate statement would be "[a] polishing method for polishing a metal film formed on a wafer surface having concave and convex patterns so as to leave the concave portions filled on said wafer surface".

***Claim Rejections - 35 USC § 102***

5. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

6. Claims 6, 12 and 16 are rejected under 35 U.S.C. 102(e) as being anticipated by Sharan (US 2003/0062269).

Sharan anticipates the invention as claimed. Sharan teaches (see abstract and paragraphs 12-23) a method of polishing a substrate by electrochemical mechanical polishing (ECMP) wherein the electric current is pulsed on and off. In such an instance, the method would have included alternating steps of CMP (when the current was off) and ECMP (when the current was on).

The ECMP is considered to be within the scope of the claim term “electropolishing” because the ECMP operation included electrolytic dissolution of the surface. Evidence of ECMP being within the scope of electropolishing is shown by the US Manual of Classification for class 205, wherein the subclasses 662 and 663 denote ECMP processes and these are indented under subclass 640 which subclass is for all electropolishing.

***Claim Rejections - 35 USC § 103***

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and

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the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

8. Claims 8, 9, 14, 15, 18 and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sharan (US 2003/0062269) in view of Downey et al (US 4,358,338) and Li et al (US 5,559,428).

The teachings of Sharan are discussed above. Sharan teaches (see paragraph 29) endpoint detection, but does not teach monitoring a change of a current waveform.

Downey et al teach (see abstract, col. 5, line 63 to col. 6, line 29) a method of detecting an end point in a plasma etching process including detecting the end point based upon a change in the derivative of the current applied to the substrate that would correspond to a change in the etching surface, such as the removal of a metal plating layer on a semiconductor substrate (see Example 1). Thus, in theory, the end point detection scheme disclosed by Downey et al is identical to the presently claimed scheme with the exception of Downey et al being related to plasma etching and not electropolishing.

Li et al teach (see abstract, summary of invention and col. 10, lines 34-38) that sensors for detecting the end points of etching processes are fully interchangeable between plasma etching and electrochemical etching. Therefore, one of ordinary skill in the art would have considered the disclosure of Downey et al to be analogous art.

Therefore, it would have been obvious to one of ordinary skill in the art to have applied the end point detection method of Downey et al in the method of Sharan because the method of Downey et al detects the end point by noticing when a change

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occurs in the rate of change of the applied current during an etching/polishing step, thereby allowing easy detection of the end point.

9. Claims 6, 7, 12, 13, 16 and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Uzoh (US 6,066,030) with evidence (for claims 7, 13 and 17 only) from Cheung (US 6,056,864).

Uzoh teaches (see abstract, figures and col. 5, lines 9-26) a method of polishing a substrate including both electropolishing (ECP) and chemical mechanical polishing (CMP). Uzoh does teach that data collected from sensors regarding the thickness of the metalized layer can be used to "select the optimum recipe of electropolishing and/or CMP processes required"..

Thus, Uzoh does not explicitly teach alternating the ECP and CMP steps.

However, based on the disclosure of Uzoh that one of ordinary skill in the art would have been capable of selecting an optimum *recipe* of ECP and/or CMP processes required, it would have been within the expected skill of a routineer in the art to have optimized the ECP/CMP blend to operate in an alternating manner in order to best achieve the proper blend of the benefits of both processes. Uzoh et al show that the ordinary level of skill in the art included the ability to choose optimum combinations of ECP and CMP to achieve desired polishing.

Regarding claims 7, 13 and 17, Uzoh fails to teach the details of the ECP and CMP processes as claimed. However, one of ordinary skill in the art was aware that ECP occurred at a faster rate (see abstract of Cheung) than the CMP, but that CMP achieved a smoother resulting surface. Thus, one of ordinary skill in the art would have

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expected the process of Uzoh to behave such that the ECP relatively roughened (with respect to the CMP) the surface, and the CMP smoothed the roughened surface.

10. Claims 8, 9, 14, 15, 18 and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Uzoh (US 6,066,030) in view of Downey et al (US 4,358,338) and Li et al (US 5,559,428).

The teachings of Uzoh are discussed above. Uzoh teach sensors (25, 27) for detecting the end point of the polishing process, by does not teach monitoring a change of a current waveform.

Downey et al teach (see abstract, col. 5, line 63 to col. 6, line 29) a method of detecting an end point in a plasma etching process including detecting the end point based upon a change in the derivative of the current applied to the substrate that would correspond to a change in the etching surface, such as the removal of a metal plating layer on a semiconductor substrate (see Example 1). Thus, in theory, the end point detection scheme disclosed by Downey et al is identical to the presently claimed scheme with the exception of Downey et al being related to plasma etching and not electropolishing.

Li et al teach (see abstract, summary of invention and col. 10, lines 34-38) that sensors for detecting the end points of etching processes are fully interchangeable between plasma etching and electrochemical etching. Therefore, one of ordinary skill in the art would have considered the disclosure of Downey et al to be analogous art.

Therefore, it would have been obvious to one of ordinary skill in the art to have applied the end point detection method of Downey et al in the method of Uzoh because

the method of Downey et al detects the end point by noticing when a change occurs in the rate of change of the applied current during an etching/polishing step, thereby allowing easy detection of the end point.

***Examiner's Comment***

11. The Examiner notes that the subject matter of claims 8 and 9 includes the scope of claims in parent application 10/304,174. As such, these claims would be obvious over those claims in view of Uzoh or Sharan as above. However, since the present divisional application was filed as a result of a restriction requirement in the parent application, no obviousness-type double patenting rejection is proper. See MPEP 804.01.

***Response to Arguments***

12. Applicant's arguments filed 24 April 2006 have been fully considered but they are not persuasive. Applicant argued that Sharan does not teach alternating of an electropolishing step and a chemical mechanical polishing step.

In response, Sharan teaches pulsing a current on and off. When the current is on, electrochemical mechanical polishing occurs, which species is an example of the genus of electropolishing. When the current is off, chemical mechanical polishing occurs. Thus, since the current pulses on and off, the process included alternating electropolishing and chemical mechanical polishing.

***Conclusion***

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP



§ 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

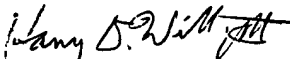
A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Harry D. Wilkins, III whose telephone number is 571-272-1251. The examiner can normally be reached on M-F 8:30am-5:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Roy V. King can be reached on 571-272-1244. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

  
Harry D Wilkins, III  
Primary Examiner  
Art Unit 1742

hdw